FLAXMAN'S SHIELD OF ACHILLES.

Mr. Freebairn has just now produced an engraving of this celebrated work, in eight plates of large size, in a portfolio, which deserve the special attention of all who are interested in high art.* The shield of Achilles, first modelled in 1818, afterwards cast in silver and gilt for George IV., is one of the finest works of modern times. It was justly spoken of by Lawrence, in his eulogium upon Flaxman, as "that divine work, unequalled in the combination of beauty, variety, and grandeur, which the genius of Michael Angelo could not have surpassed."

"Five ample plates the broad expanse compose,
And god-like labours on the surface rose.
There shone the image of the master mind;
There earth, there heaven, there ocean he designed."

The effect on the progress of the arts, produced by this and other of Flaxman's productions, was great and widely spread. "We may affirm," says Cicognara, "that they have mainly contributed to awaken sculpture from a certain monotonous lethargy, and to restore the golden style,—the severity of the antique—which he knew how to apply to his own designs."

The fidelity and beauty of the engravings before us are beyond all praise; were Flaxman alive, he would be proud to see his noble work so nobly transcribed. We sincerely hope that Mr. Freebairn's labours will meet with the encouragement they deserve. A very large sale can scarcely be looked for; it is therefore the more incumbent on the discriminating few to give their aid; and they may rest satisfied, that by assisting to increase the circulation of such a production as this is, they are advancing a good cause. When the works of Flaxman are fully appreciated amongst us by the multitude, the arts will take a high place in England.

The engravings are accompanied by a portrait of the great sculptor, from a model by himself, and the illustrated passage of the Iliad, in Greek, English, German, and French.

* Published by himself, at 23, Mornington-place, Hampstead-road.

ON THE DEVELOPMENT AND CONVERSION OF CONVEX SURFACES.

In No. 168 of The Builder there is given a method of converting the convex superficies of a cylinder and cone into a circle of equivalent area, or of finding geometrically the radius of a circle that shall contain an area precisely equal to the cylindrical and conic developments. This method of conversion, however extensive it may be as applied to right-lined figures, is very limited in its application to solid bodies bounded by curved surfaces; for, with the exception of the cylinder and the cone, together with their various ungulas, hoofs, and frustums, there is no other solid figure so bounded, that admits of a perfect geometrical development or expansion upon a plane. The sphere and its various segments and zones are, it is true, convertible; that is, a circle can always be found to contain an area equal to the convex surface of a sphere, or any segment or zone thereof; but since these bodies are bounded by a convexity of double curvature, they do not admit of a rigorous geometrical development; and for this reason it is not intended to include them in the present inquiry; we shall, therefore, proceed with the consideration of the conic frustum, a figure which furnishes another beautiful application of the principle, so successfully employed in the conversion of the cylindrical and conic superficies mentioned above.

Let $AabB$ be a conic frustum, of which the diameters are AB and ab, the corresponding planes being parallel to each other, and the slant sides, Aa and Bb, equal and symmetrically placed in reference to the diameters AB and ab. Produce the slant sides, Aa and Bb, to meet each other in the point V; then is V the vertex, and AVB the complete cone from which the frustum, $AabB$, is cut. Here, then, it is obvious, that the convex surface of the frustum is equal to the difference of the surfaces of the containing cones, AVB and aVb.

Put $D = AB$, the greater diameter of the frustum; $d = ab$ the lesser diameter; $l = AV$ the slant length of the entire cone, the vertical length or axis being VH, and let $\pi = 3{\cdot}1416$, the circumference of a circle whose diameter is an unit; then, since the circumferences of circles are proportional to their diameters, we have

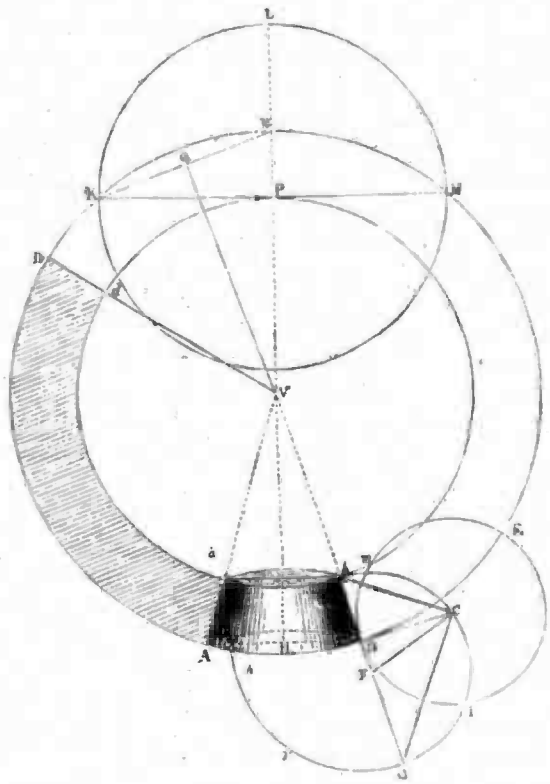
$1 : \pi :: D : D\pi$, the circumference of the greater end of the frustum; and

$l : \pi :: d : d\pi$, the circumference of the lesser end.

But the convex surface of a right cone is expressed by the product of its slant length and half the circumference of its base; consequently, the convex surface of the whole cone, AVB, is expressed by the term $\frac{1}{2}D\pi l$, and that of the upper cone, aVb, by the term $\frac{1}{2}d\pi \times \overline{aV}$; therefore, by taking the lesser of these expressions from the greater, we get $\frac{1}{2}\pi(D l - d \times \overline{aV})$ for the convex surface of the conic frustum, $AabB$, being the same as the rule usually given for that purpose in books of mensuration. But in order to exterminate the quantity aV from the above expression, we must find its value in terms of D, d, and l, which are supposed to be given in the problem; and for this purpose, we must have recourse to the similar triangles, AVB and aVb, constituted by a section along VH, the axis of the cone, from which we get, $D : d :: l : \frac{dl}{D}$; that is, $a\overline{V} = \frac{dl}{D}$; therefore, by substitution, the surface of the conic frustum becomes as follows, viz.:—

$$surface = \tfrac{1}{2}\pi(D + d) \times \frac{l}{D}(D - d)$$

Now, it is here manifest, that the member, $\frac{1}{2}\pi(D+d)$ expresses one half the sum of the circumferences of the ends of the frustum, of which the diameters are D and d; and the other member, $\frac{l}{D}(D-d)$ is obviously the slant distance between the circumferences. If, therefore, we suppose the cone, AVB, to roll itself upon the plane of the paper, about the vertex V as a centre, every part of the convex surface of the frustum will apply itself to the annular segment, $ADda$; and when the side, AV, on which the rolling motion commences, coincides with DV, the development of the frustum's convex surface will be represented by,



and equal to the annular segment just mentioned; and we have now to shew how, according to the principle we are discussing, we can determine geometrically the radius of a circle that shall contain precisely the same area as the annular segment, $ADda$.

Let δ represent the diameter of the circle required, then, by the rule for a circular area, we have $\frac{1}{4}\delta^2\pi$; and if this be compared with the area of the annular segment, or the surface of the conic frustum above given, we get

$$\tfrac{1}{4}\delta^2\pi = \tfrac{1}{2}\pi(D+d) \times \frac{l}{D}(D-d),$$

and by expunging the common symbol and extracting the square root of both sides of the expression, we obtain the following form as the germ of construction; that is,

$$\tfrac{1}{2}\delta = \sqrt{\tfrac{1}{2}(D+d) \times \frac{l}{D}(D-d)};$$

an expression which implies, that the geometrical mean between half the sum of the diameters and the slant length of the conic frustum, is equal to the radius of a circle containing an area precisely equal to the convex surface; hence the following construction.

From a, the extremity of the shorter diameter ab, let fall the perpendicular ah, meeting the longer diameter AB in the point h; then is Bh half the sum of the diameters AB and ab. Produce bB the slant length of the frustum directly forward to G, and on B, as a centre, with the distance Bh, describe the circular arc hrG, meeting bB produced in G, and making BG equal to Bh, so that bG is equal to the slant length of the frustum, and half the sum of its diameters extended in one line. Bisect bG in F, and on F as a centre, with FG or Fb as radius, describe the semi-circle bCG, and, at the point B, erect the perpendicular BC, meeting the semi-circle bCG in C; then is BC the radius of the circle sought, being a geometrical mean between bB, the slant length of the frustum, and BG, half the sum of its diameters. Upon C, as a centre, with the radius CB, describe the circle $BmEI$, and it will contain exactly the same area as the annular segment $ADda$, which is equal to the development of the convex surface of the conic frustum.

The construction of the annular segment $ADda$ is very simple; for since the exterior arc, AD, is equal in length to the circumference of a circle whose diameter is AB, and the interior arc, ad, equal to the circumference of a circle whose diameter is ab, it follows that the angle AVD, at the centre of the sector, bears the same proportion to 180 degrees, or a semicircle, as the diameter AB does to AV, the

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